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**What pedagogical approaches can effectively include children with special educational needs in mainstream classrooms? –A Systematic literature review**

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**Introduction**

The growing demand for inclusive practices within mainstream schools has resulted in classroom teachers having to take direct responsibility for the individual learning needs of all pupils within the setting. A recent report from the Office for Standards in Education (OFSTED, 2004) found, however, that many schools in England and Wales still do not see themselves as having the skills, experience or resources to effectively provide for children with special educational needs. This is despite evidence that increasing numbers of children with special educational needs are making good progress. The belief in a need for special pedagogical approaches for these children has also been widely critiqued (see e.g. Hart, 1996; Thomas & Loxley, 2001) and there has been a growing focus upon the teaching practices that can be, and are, more broadly used by mainstream practitioners.

An issue for teachers is the lack of useful and valid research evidence on which to base conclusions about effective pedagogy for children with special educational needs. This is not just to do with the amount of research that has taken place but is also a consequence of how people

understand pedagogy and how they define SEN groups (Norwich and Lewis, 2007). In addition, complex studies are often not reported in the professional media and so are not readily available to teachers. There is a role therefore, for reviews which take an overview of the available research and synthesise the broader findings. For example, reviews have established that there is little evidence to justify the use of a specific pedagogy for each type of special educational need (Norwich & Lewis, 2001) and clarified some of the wider policy, support and organisational elements that are effective in inclusive education (Sebba & Sachdev, 1997). These reviews can themselves be relatively inaccessible, however, going into a great deal of detail about the research process, its validity, reliability and theoretical underpinnings, and therefore requiring further synthesis and presentation to be of value to practitioners. This paper aims to serve as just such a synthesis, presenting the key aspects from three reviews of over one hundred and ten pages each, both to explicate the research process and the practical outcomes for practitioners.

This paper reports on a three-year programme of systematic reviews (Nind and Wearmouth, 2005; Rix and Hall, 2006; Sheehy and Rix, 2008), which sought to identify classroom practices that support the inclusion of children with Special Educational Needs. Across the three years the researchers systematically reviewed the literature with reported outcomes for the academic and social inclusion of pupils with special educational needs; the review team focused upon peer group interactions, the nature of teacher and pupil interactions and whole class, subject based, pedagogies in order to begin to answer the overall question (Q1):

*What pedagogical approaches can effectively include children with special educational needs in mainstream classrooms?*

Given the wide range of critiques of the term Special Educational Needs with, for example, its suggestions of otherness (Potts, 1998) and niceness (Corbett, 1996), the review took it to mean the learning needs of all those pupils identified as experiencing difficulties in learning of any kind, together with those identified as experiencing a categorised difficulty.

The systematic reviews were funded by the Training and Development Agency for Schools as part of a programme intended to produce an evidence base for practice. The intention of the systematic review process is to ‘synthesize the findings of many different research studies in a way which is explicit, transparent, replicable, accountable and (potentially) updateable’ (Oakley, 2000, p3). However, it has been criticised for implying that it is more thorough than other sorts of reviews (Hammersley, 2001), for overly simplifying complex issues (MacLure, 2005) and for eliminating ‘vast amounts’ of literature (Allan, 2008, p50). The tensions experienced within the review process are discussed elsewhere (Nind, 2006). This paper presents findings about effective values and practices, recognising the complexities of the classroom, and underlining the importance of teachers working in collaboration with others.

Before we can go on to present and discuss the findings we summarise the systematic review process or, put simply, the evidence trail that led to our findings and conclusions. An important element in this description is the quality assurance procedures that were applied to ensure the trustworthiness of our approach to the entire review. This also involved, where appropriate, an evaluation of the trustworthiness of the individual studies that influenced the findings and the conclusions.

## **Methods**

The systematic review was conducted using the protocols established by the Evidence for Policy and Practice Information and Coordinating Centre (EPPI-Centre), and with due attention to the quality assurance procedures established by EPPI at every stage. The overall question (Q1) was identified by the review team and agreed with the advisory group of academics and practitioners. An electronic search of databases was conducted in each of the three years, using Q1 as the

guiding question. A range of electronic databases and citation indexes were searched as well as a variety of internet sites. This electronic search used a variety of keyword terms, drawn from the educational terminology of different countries, and from the British Education Thesaurus. These citations were imported into EndNote bibliographic software and the EPPI-Centre systems. In each year, they were screened on the basis of their titles and abstracts by two members of the research team. This initial screening involved the application of eight agreed inclusion/exclusion criteria (see Table 1), which defined the subsequent scope of the review. To be included in the review the paper had to meet all of the inclusion criteria and none of the exclusion criteria.

**Table 1: Review inclusion/exclusion criteria**

	<b>Inclusion Criteria</b>	<b>Exclusion criteria</b>
<b>Criterion 1</b>	Include a focus on students who experience special educational needs of some kind	Not focused on pupils who experience special educational needs of some kind
<b>Criterion 2</b>	Be conducted in mainstream classrooms	Not conducted in mainstream classrooms
<b>Criterion 3</b>	Include pedagogical approaches	Not concerned with pedagogical approaches
<b>Criterion 4</b>	Include an indication of student outcomes	Not indicating pupil outcomes
<b>Criterion 5</b>	Be concerned with the 7-14 age range or some part of it	Not concerned with all or part of the 7–14 age range
<b>Criterion 6</b>	Be empirical – exploration of relationships, evaluations or systematic reviews	Descriptions, development of methodology or reviews other than systematic reviews
<b>Criterion 7</b>	Be written in English	Not written in English
<b>Criterion 8</b>	Be published after 1994	Not produced or published in or after 1994

Following the screening process, copies of papers were sought and given a second more detailed reading, where again the inclusion/exclusion criteria were applied. A cut-off date for retrieval was set for each year. This second reading also involved two people screening independently.

The papers that passed through this screening process were now keyworded using two sets of keywords. The first set used the EPPI-Centre (2003) Keywording Strategy (version 0.9.7), whilst the second set used a review specific strategy designed by the research team. This second keywording strategy was initially designed in Year 1, but was updated and expanded in Years 2 and 3. This keywording was carried out by pairs of reviewers working independently and then moderating their findings. This keywording process created a descriptive ‘systematic map’ of the studies. This map offers an overview of the studies and the research within them, giving details of their aims, methodologies, interventions, theoretical orientation, outcomes and so on. The keywording process did not assess the quality of the studies, rather its intention was to describe and map the research terrain.

The full review team now had detailed discussions about the priorities for the in-depth review, given that our findings needed to be of direct relevance to teachers in training and newly qualified teachers as well as teacher educators. Given the detailed nature of the EPPI review process it would not be possible in the allotted timeframe to review all the studies identified, and so each year the original research question was refined to focus on a more specific theme within it. In the first year, we focused upon peer-group interactive approaches since this proved to be the prominent category identified through the keywording process. In the second year, the team chose to look across all the identified pedagogic approaches, and in response to suggestions from advisors and an identified need within academic literature (Skidmore, 2004) focused upon individual interactions within the classroom regardless of the pedagogical approach adopted. Similarly, in the third year, the review team looked across the identified approaches, and responding to comments of users suggesting that many teachers still find themselves working independent of support for a large part of any working day, identified approaches that are effective with the whole class regardless of the subject being taught.

In each of the three years, the focus was encapsulated within a new sub-question (see table 2), and the new priorities were transposed into another set of inclusion and exclusion criteria (see table 3). These criteria were applied to the studies in the descriptive systematic map so as to produce the relevant studies for the in-depth review. The studies identified for the in-depth review were now closely assessed by two independent reviewers. This process, known as data-extraction, was carried out using generic guidelines set by the EPPI-Centre and review-specific guidelines created by the review team. Any differences between the two reviewers were discussed and resolved, as in the case of the keywording described above. As part of this process each study was assessed for its appropriateness, coherence and relevance, so that the reviewers could assess its reliability and trustworthiness and decide its weight of evidence in relation to answering the in-depth review questions. The extracted data and assessments were now used by the main authors to identify central themes and findings across the studies.

**Table 2: In-depth review questions**

<b>Year 1</b>	<p>a. Does a pedagogy involving a peer group interactive approach effectively include children with SEN in mainstream classrooms?</p> <p>b. How do mainstream classroom teachers enhance the academic attainment and social inclusion of children with special educational needs through peer group interactions?</p>
<b>Year 2</b>	What is the nature of the interactions in pedagogical approaches with reported outcomes for the academic and social inclusion of pupils with special educational needs?
<b>Year 3</b>	What is the nature of Whole class, subject based, pedagogies with reported outcomes for the academic and social inclusion of pupils with special education needs.

**Table 3: Criterion for inclusion in each year's in-depth review**

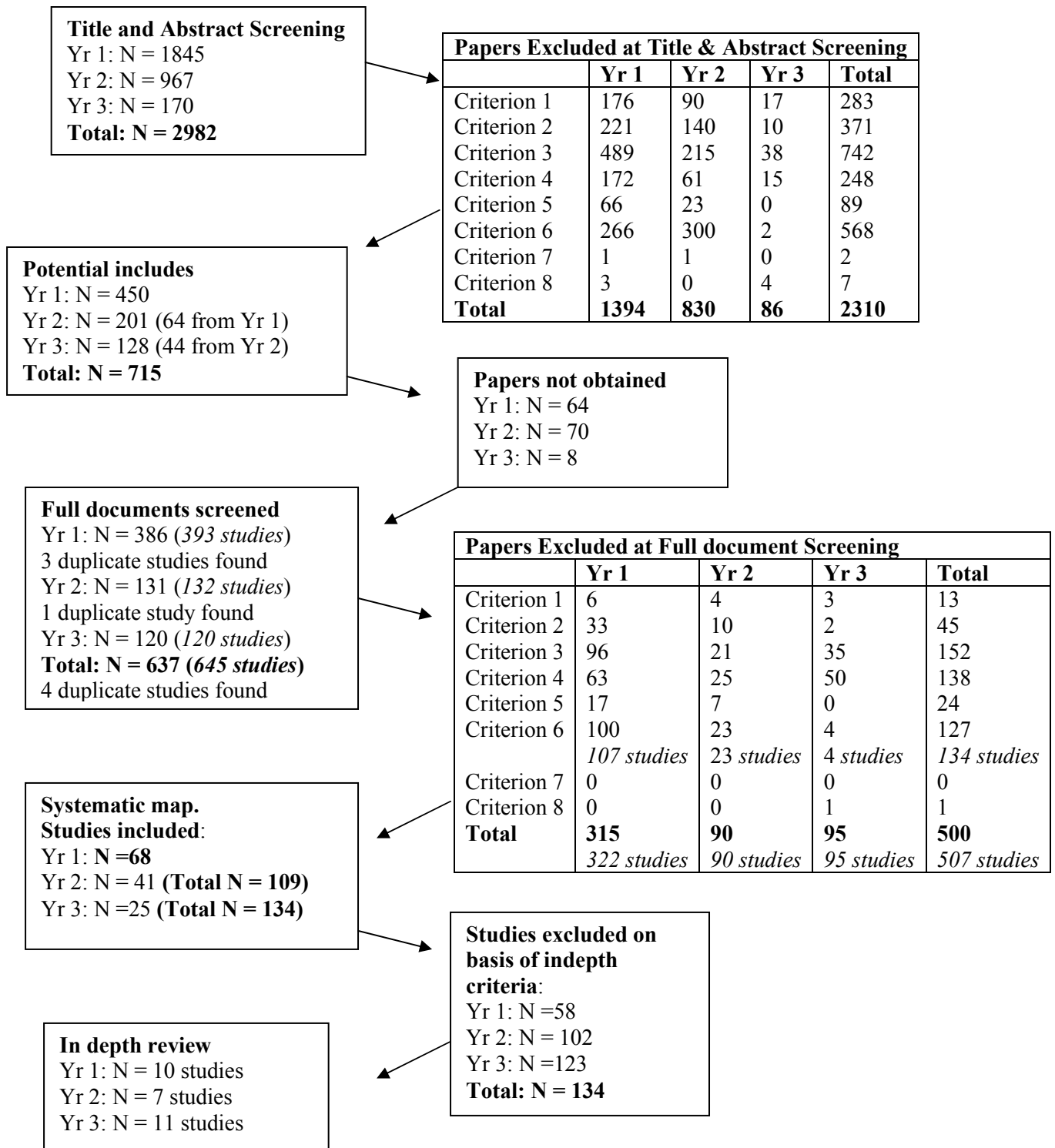
<p><b>Year 1</b></p> <ul style="list-style-type: none"> <li>• focused on a peer group interactive pedagogical approach beyond peer tutoring or behavioural prompting;</li> <li>• conducted by mainstream classroom teachers without necessitating additional staff support;</li> <li>• giving an indication of academic and social interaction/involvement outcomes measured through systematic data gathering.</li> </ul>	<p><b>Year 2</b></p> <ul style="list-style-type: none"> <li>• has a focus on teaching and learning;</li> <li>• has a focus on outcomes for the academic achievement and social inclusion of pupils with special educational needs;</li> <li>• involves a collaborative teaching approach;</li> <li>• based on exploration of relationships or evaluations;</li> <li>• does not focus upon programmatic interactions.</li> </ul>
<p><b>Year 3</b></p> <ul style="list-style-type: none"> <li>• learning aims were set for the whole class but not for individual children;</li> <li>• learning tasks were subject specific;</li> <li>• pedagogy in practice i.e. teaching practice was stated or described.</li> </ul>	

## Results

In the first year, after duplicate papers had been removed, 1845 papers were identified; in the second year, using the same search terms, a further 967 papers were added; and in the final year an additional 170 papers were included. In total across the three year 2982 papers were screened. Of these 2310 titles and abstracts demonstrated that the paper did not meet the inclusion criteria and were excluded, leaving a total of 715 potential papers across the three years, 78 of which we were unable to obtain. Across the three years 637 papers were fully screened, and examined to see if they met the inclusion criteria, and 507 of these did not and 4 turned out to be reporting on the same study. In all 134 studies were therefore included in the descriptive systematic map across the three years. Given that each year involved a new search however, the systematic map grew across the period. In year 1 there were 68 papers in the map, in year 2, there were 109 and papers and in year 3 there was the full 138. (See Table 4)



**Table 4: Filtering of papers from initial searching to in-depth review**



### ***Systematic Map***

In the detailed keywording of the 134 studies within the systematic map, a range of issues were evident. Nearly 80% of the studies had been conducted in the USA and only 10% in the UK.

Within the USA researcher-manipulated evaluations were by far the most common study type, meaning that in the majority of studies available to us the researcher had in some way changed people's experience and had some control over who experienced what; only 18% of studies were 'naturally occurring'. As might be expected, given that Criterion 4 excluded studies that did not indicate pupil outcomes, over 95% of the studies had a focus upon learners and over 85% had a focus upon teaching and learning. Over 77% of the studies involved mixed sex groupings, and despite 70 % of the studies being based in primary schools, 67% of studies included members of the age range 5-10 years and 60% include members of the age range 11-16. It was felt that Criterion 5, which excludes studies from the map which were not all or part of the 7-14 age range, may have had an impact here. Another complication was the tendency, particularly in US papers, to identify pupils by their grade but not by their age. It was noted also that of single sex studies, boys were more than four times as likely to be the focus as girls (although the numbers of such studies remain small; with 4 and 18 studies working with girls or boys respectively).

In many studies the curricular area was noted, but not necessarily a central focus of the research. The most common curriculum focus was literacy, followed by general curriculum, then Mathematics and Science. This reflects the current priorities for US and UK policy makers, as well as the nature of the curriculum for primary age pupils. Over 70% of studies aimed to raise the academic attainment of pupils, with 47% aiming to enhance social interaction and involvement, and 23% of studies intended to improve behaviour. A number of studies identified more than one aim for the approach being researched. As a consequence of these aims there was preponderance of studies reporting that they had 'raised raising academic attainment', followed

by those which had ‘enhanced social interaction’, and then those that ‘improved behaviour’, but the majority reported more than one area of success. This notion of success was generally judged by the researcher carrying out the study, with teachers only involved in 38% of judgements and pupils in 19%. The studies involved a wide range of practitioners as teachers; however, it was evident that over 60% of the studies involve some sort of collaboration or teacher support and under 30% involve the regular teacher on their own. Given this high level of collaborative involvement it is worth noting that less than a quarter of the studies considered the interactions of pupils, teachers and support staff (21%), pupils and support staff (19%) and between staff (18%) whilst the majority did consider pupil-teacher interactions (77%) and pupil-pupil interactions (59%).

The most common teaching approach was the adaptation of instruction, followed by peer group interactive and then adaptation of materials. This is reflected in our choice of focus across the three years. The forms of interaction that underpinned these approaches were primarily verbal and then written. There was a comparative failure to include, for example, more pictorial, hands on activities or signing within these studies. Only two of the 134 studies involved the use of signed communication.

### ***In-depth review***

Subsequent to this detailed analysis of the studies in the systematic map the in-depth inclusion/exclusion criteria (see table 3) were applied in each year. Twenty-three studies were identified across the review, with 10 serving as the focus in year 1 (5 for question a) and 7 for question b)), 7 in year 2 and 11 in year 3.

In Year 1, nine of the studies were conducted in the USA and one in the UK. Seven of the studies took place in primary schools, two in middle schools and one in a secondary school. Seven of the

studies included a focus on literacy, two on literature, two were cross curricular, one focused on mathematics and another on science. One had no explicit curricular focus. In Year 2, five of the studies were from the USA with one from Canada and one from Australia. The studies were equally divided between primary and secondary phases of education. Three were conducted within Science classes, two did not have a specific curricular focus, one drew upon a general curriculum and the other upon Literacy. Four of the studies had verbal interactions to the fore, with written, technological and auditory interactions being considered in the other papers. In Year 3, all eleven studies were carried out in the schools within the USA, and nine were within primary schools or their equivalent. Five studies concerned literacy-first language, four focused on History, two on social studies one on Mathematics and one on Science. Across all three years, there was a broad mix of special educational needs focused upon within the studies, including those with learning impairments, physical impairments, sensory impairments, and emotional and behavioural difficulties.

In Year 1, five studies were weighted as medium-high or medium in their appropriateness of design, (Frederickson, 2002; Stevens, 1995a; Cushing, 1997; Palincsar, 2001; Stevens, 1995b), and five were weighted as low, whilst four were weighted high for the appropriateness of their research question (Cushing, 1997; Frederickson, 2002; Palincsar, 2001; Stevens, 1995a), three were weighted medium (Stevens, 1995b; Summey, 1997; Beaumont, 1999) and the other three were low-medium or low. In Year 2, two papers (Palincsar et al, 2001; Wallace et al, 2002) were deemed to be of high trustworthiness in their appropriateness of design and the appropriateness of their research question; two further studies (Jordan and Stanovic, 2001 and Rieth et al, 2003) were allocated a medium rating on both counts, another (Tindal and Nolet, 1996) obtained a medium rating for appropriateness of design, and two were weighted as low. In Year 3, three studies (Miller et al, 1998, Morrocco et al, 2001; Palincsar et al ,2001) were weighted as high rating in their appropriateness of design and the appropriateness of their research question in

relation to the in-depth question. On the same criteria 7 studies were weighted Medium and one study weighted as Low.

In identifying emerging themes within the studies (see Table 5) the weight of evidence allocated to the identified studies was taken into account. Therefore the studies in which the reviewers placed the most confidence, regarding weight of evidence with respect of the review question exerted a greater influence in the synthesis and also the subsequent discussion related to practice, and its implications for further research and policy.

**Table 5: Emerging themes from the three in-depth reviews**

<b>Year 1</b>	<b>Year 2</b>	<b>Year 3</b>
1. the model of student-as-learner; 2. integration of academic and social considerations; 3. organisational and organised support; 4. holistic views of 'basic skills'; 5. shared philosophy.	1. interaction and the mediating role of the teacher; 2. interaction, cognitive level and engagement; 3. interaction and the learner's voice; 4. interaction and knowledge as contextually-grounded.	1. pedagogic community; 2. social engagement; 3. modality of activities; 4. scaffolding; 5. authentic tasks.

### **Description of Emerging themes**

In Year 1 the peer interactive approaches assessed provided a small evidence base of how these approaches were used by teachers, supporting the effectiveness of cooperative learning (particularly in relation to the curriculum area of literacy), encompassing elements of social grouping/teamwork, revising and adapting the curriculum and working with a cooperative learning school ethos. Evidence of effectiveness was also found for Guided Inquiry and Circle of Friends. Peer group interactive approaches were effective in academic terms (except in relation to Circle of Friends) and were often effective in terms of social participation and children's attitudes to their learning and their views of their own competence, acceptance and self-worth.

Underpinning the interventions within these studies was a model of student as learner in which they had active agency in the construction of personal knowledge and belong to and participate within a learning community. This indicated a role for a shared philosophy and common concern with co-operative and collaborative participation. Many of the interventions took a holistic approach to skill development in contrast to the isolated skill development of traditional remedial programmes. The learners' co-construction of knowledge was supported by teachers through peer scaffolding and dialogue, and was facilitated through teachers' use of organisational support for community participation and careful planning with peers and adults together. A strong inference from the studies is that effective use of peers involves making skill development socially meaningful.

In Year 2, a common theme across all the studies was the powerful role the teacher played in shaping interactions and influencing learning opportunities through those interactions. Positive teacher attitudes towards the inclusion of children with special educational needs were reflected in the quality of their interactional patterns with all pupils and, in turn, in their pupils' self concept. Those teachers who saw themselves responsible for fostering the learning of all promoted higher order interaction characterised by questions and statements involving higher order thinking, reasoning, and implicating a point of view. They engaged in prolonged interactions with pupils with special educational needs and used most of the available time to offer learners the opportunity to problem-solve, to discuss and describe their ideas, and to make connections with their own experiences and prior understandings. Those teacher interactions that were less successful focused on procedural matters, behaviours and general classroom management. Successful interactions, which supported fuller pupil participation, also encouraged pupils to identify their thoughts and assisted them to document them, particularly through one-to-one discussion with the teacher, and often involved elicitation of prior knowledge and understanding. In carrying out these discussions the teacher matched their questions and answers

to the pupil's response, following the pupil's thinking rather than just checking that their understanding equated to the teacher's. There was also some evidence to support interactions having a meaningful relationship to learners' daily lives, involving direct experiences and realistic problems, offering multiple opportunities to engage with the learning situation and others within it.

In Year 3 the whole class, subject-based pedagogy that demonstrated effectiveness was mediated by a teacher who was part of a 'teacher community', either within the school or more often from outside the school. The teacher's pedagogical practice was supported by this community with a shared model of how children learn. They had a unified understanding of the characteristics, skills and knowledge associated with the subject to be taught, and also of the aims of the structured programme and the subject, understanding what they were trying to achieve in terms of academic and/or social inclusion. The pedagogy gave importance to the social engagement of learners and included activities in which social interaction was seen as the means to enhance the academic and social inclusion of children with special educational needs. These used, monitored and developed pupils' social engagement as an end in itself, as well as a way of facilitating the development of knowledge. There was also a clear role for activities which were visual, verbal, and kinaesthetic and it was evident that the use of different modalities made the subject knowledge accessible to a diverse range of learners. Echoing evidence from the previous years, through interactions between teachers and children and among children, academic and social inclusion was enhanced when pedagogical approaches were planned with, and made explicit, to learners. Effective subject specific learning activities for pupils with special educational needs were seen to begin with an awareness of the needs of the learner and then the development of their understanding, knowledge and skills through small incremental steps, frequently contextualising what was to be learned in the form of a real life or learner relevant inquiry or problem.

## **Discussion**

### ***Strengths and limitations of the review***

This review incorporated research studies from 1994 and involved pupils aged between 7 and 14. It drew on evidence from a full range of students and settings in this age group. It included studies that represented a broad range of special educational needs, and offered a reasonable range of curricula foci. It also drew upon studies of varying size, from a case-study of one child to a study of one hundred and eighteen classrooms. The final synthesis, by its nature means that the number of studies in each year's in-depth synthesis was small, but across the three years, we were able to ask relevant questions of use to teachers where limited resource is an issue. Given that alternative review questions could be asked and that alternative exclusion and inclusion criteria could have been legitimately constructed, other reviews – as well as narrative review approaches - could offer different and equally valid insights into the area.

The quality of the studies within the review and the rigorous quality-assurance at all stages provides confidence in the review findings. The number of studies which had a low weight of evidence overall is a limiting factor, as is the lack of information available about the teachers involved within the studies. There was also a preponderance of studies from the USA, which limits certainty about the context and cultural equivalence of studies, and therefore the generalisability of findings. In addition, studies identified reported largely positive outcomes. This could reflect a bias in the inclusion/exclusion criteria or within the studies themselves, from a publication bias towards 'successful' results. This means there is no opportunity for falsification of approaches across studies. It is also worth noting a lack of random assignment between, and rigorous control of, comparison groups within the studies overall. This reflects current approaches to the complex variables within educational research in the area of inclusion. However real-world



complexity was evident within the studies and in conducting this review the research team was aware that pedagogical approaches for inclusion cannot be easily reduced.

### ***Implications for policy, practice and research***

There is a shortage of evidence about the nature of teaching approaches that effectively include children with special educational needs in mainstream classrooms. There is a need for more UK and secondary based research, and more rigorously designed studies to evaluate teaching approaches. Consideration should be given to indicators of pupil progress that are rich and varied and not just to indicators that are readily measurable. There is a also need for research into teachers working alone within inclusive settings, and about their interactions with support staff and pupils, particularly in relation to interactions involving tactile and signed modes of communication.

Within the current research base there is evidence that peer group interactive approaches can be effective, and that teachers are more likely to be effective with all pupils if they use language to draw out pupils understandings, encouraging further questioning and links between new and prior knowledge. There is evidence too that teachers' ability to include all pupils in whole class activities is enhanced if they have a shared curricular and pedagogic understanding and can become part of, and sustain membership of communities of practice involving teaching staff, teacher educators, and academics. Given the complexities of working within inclusive settings, teachers in training need opportunities to reflect on their practices and the perspectives of others in the light of this existing research.

Of particular relevance to practitioners is the evidence that teachers who see the inclusion of pupils with SEN as part of their role are more likely to have effective, high-quality, on-task

interactions. Many will also recognise the importance of subject specific curriculum skills, facilitated by the use of authentic tasks, accessed through varied modes, and the value of scaffolding cognitive and social skill development in ways that utilize the social engagement of the learners. They will appreciate too the need for sufficient planning and preparation time to collaborate with others in the development of curriculum activities and understanding that facilitate this process.

In summary, there are important implications for practice. Teachers need to:

- recognise their central responsibility for all pupils that they teach
- engage with a 'teacher community' - either within the school or more often from outside the school - who have a shared model of how children learn
- see the other adults within the school community as both teachers and learners
- develop a shared philosophy around respecting everyone in the class and all their learning
- recognise that social interaction is the means through which student knowledge is developed
- understand the aims of the structured programme and subject, with a shared understanding of the characteristics, skills and knowledge associated with the subject to be taught
- plan to scaffold both the subject's cognitive and social content
- carefully plan group work, delineating the roles of group members
- explore pupils understandings , encouraging questioning and the making of links between new and prior knowledge
- work on (basic) skills in a holistic way, embedded in classroom activity and subject knowledge
- utilise pupils as resources for learning

- use activities which the learner finds meaningful
- use a range of different modalities, which are frequently ‘hands-on’ and offer diverse opportunities to engage with the concepts and with others’ understandings of those concepts

Meeting these needs presents a very demanding brief for an unsupported classroom teacher. Inherent within effective practice, therefore, is a coherent ethos and support structure which allows the teacher to reflect on and develop their practice, exploring pedagogic approaches and subject specific knowledge in an ongoing manner.

## **Conclusion**

An underlying premise of this review is echoed in Palincsar et al’s (2001) conclusion that generic teaching approaches, for children with special educational needs ‘do not reflect the unique demands of learning subject-specific matter and are not generally recognized as advancing the learning of all students’ (p30).

This series of reviews should encourage teachers to recognise that within the complexities of a diverse mainstream classroom their effectiveness will be dependent upon their own understanding of their role, their facility to adapt their teaching and curriculum, and their willingness and ability to encourage participation in a communal learning experience through flexible groupings and roles. Pedagogical approaches which effectively include children with special educational needs in mainstream classrooms are not about the teacher alone, but are rooted in the community of learners - including other practitioners - with whom they work.

The reviews support the importance of social engagement in enhancing the academic and social inclusion of children with special educational needs and highlight a social constructivist perspective as being significant. Teachers need opportunities to explore and reflect upon this view of learning and to develop pedagogies which use, monitor and develop pupils' social engagement, both as an end in itself, and as a way of facilitating the development of knowledge

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